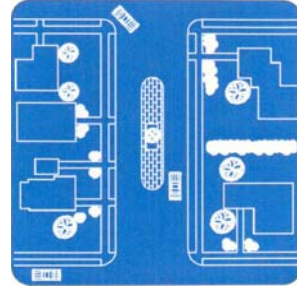
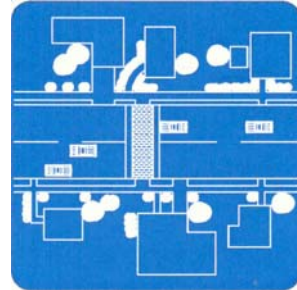
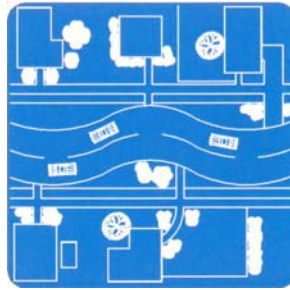


MD 787 (Flower Avenue) Traffic Calming Study



September 2003

Prepared for:



Sabra, Wang & Associates, Inc.
Engineers • Planners • Analysts

I. INTRODUCTION

This study is performed at the request of the Maryland State Highway Administration's District 3 Traffic office. The purpose of this study is to evaluate MD 787 (Flower Avenue) for traffic calming between MD 320 (Piney Branch Road) to the north, and MD 195 (Carroll Avenue) to the south. The study section is located in the City of Takoma Park in Montgomery County. The study route is highlighted in the area map in **Figure 1**.

The traffic calming study was prompted by a "Safe Routes to School Action Plan" study that was performed in the vicinity of the Rolling Terrace Elementary School. The study recommended a list of priority improvements that included "conducting a traffic calming study on Flower Avenue and making improvements to the sidewalks, curb ramps and crosswalks." The basis for the recommendation was concerns by area residents regarding the poor condition of the sidewalks, speeding on Flower Avenue, and difficulty and safety in crossing Flower Avenue.

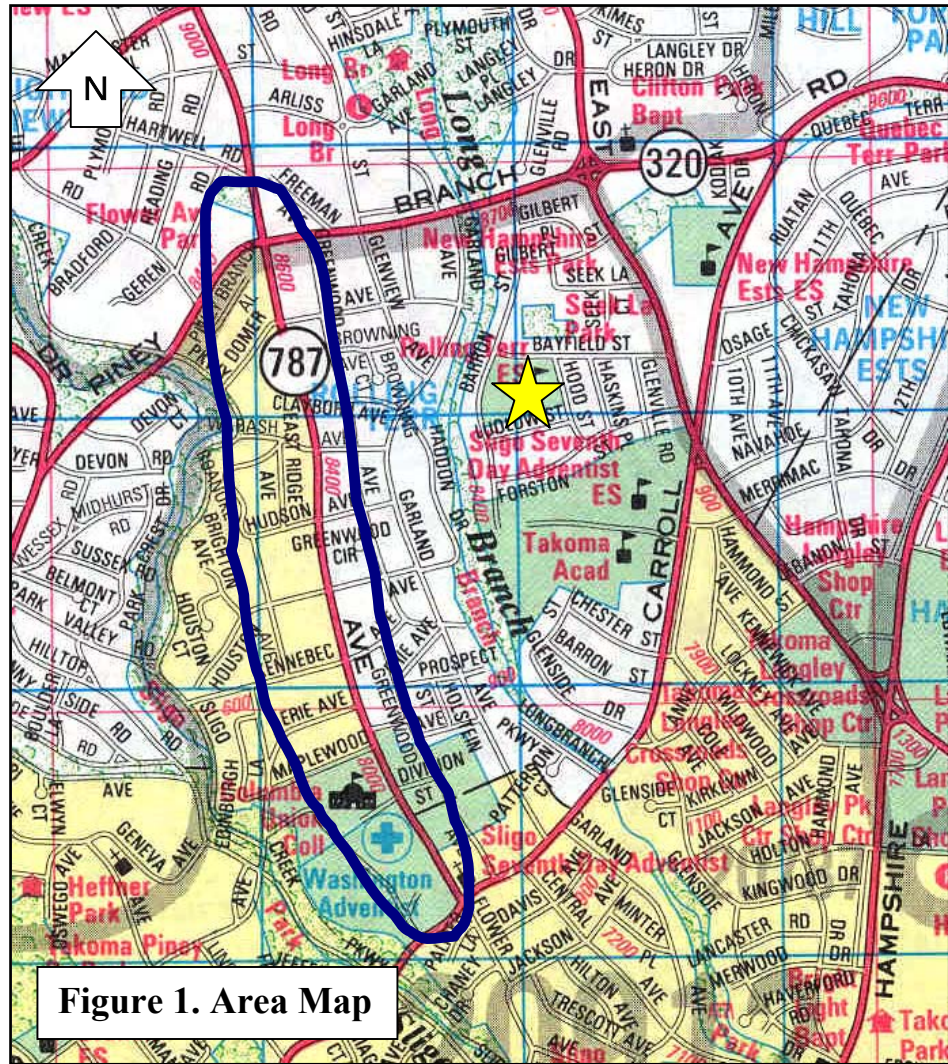


Figure 1. Area Map

II. MARYLAND SAFE ROUTES TO SCHOOL ACTION PLAN

Section 3 of House Bill 717 commissioned the Bicycle and Pedestrian Advisory Committee to "initiate a pilot project on child pedestrian safety, focusing on routes to schools in target areas." The primary goals are to "reduce the frequency and severity of crashes involving child pedestrians and to increase the number of children who walk or bike to school." Rolling Terrace Elementary School was one of two schools selected for study in this pilot program.

III. ROLLING TERRACE ELEMENTARY SCHOOL

This section of the report presents information about Rolling Terrace Elementary School as well as summarizes selective information from the Maryland Safe Routes to School Action Plan and Report as it relates to Rolling Terrace Elementary School. **Figure 2** illustrates the school boundary area. Note that Flower Avenue divides the western third of the school area from the eastern two-thirds; school children must cross Flower Avenue in order to walk to school. The school had an enrollment of 749 students for the 2002-2003 school year. School begins at 8:50 AM and ends at 3:05 PM. According to a survey performed at Rolling Terrace, approximately 47% of school children walk, bike or roller blade to school (see **Figure 3**), which is significantly higher than the 13% national average. There is a school crossing guard at MD 787 (Flower Avenue) and Domer Avenue. According to Montgomery County Public Schools, school buses pick-up and drop off school children at the following locations along MD 787 (Flower Avenue):

- MD 195 (Carroll Avenue)
- Maplewood Avenue
- Houston Avenue
- Hudson Avenue

IV. LOCATION DESCRIPTION

MD 787 (Flower Avenue) is a two-lane, two-way roadway, classified as an urban collector. The posted speed limit is 25 miles per hour (mph). The roadway width varies between 28 and 32 feet. The entire one-mile length of MD 787 is discussed in this report. On-street parking is allowed along the western side of MD 787. The northern terminus at MD 320 is commercial. The southern third of the roadway is bordered on both sides by Columbia Union College and Washington Adventist Hospital. The middle portion is primarily single-family homes and apartment buildings that were converted from single-family homes. Residential driveways have direct access to MD 787.

A 5-foot wide, concrete sidewalk exists along the western side of MD 787. There is a sidewalk on the eastern side of MD 787 for approximately $\frac{1}{2}$ of the corridor. The sidewalk is mostly

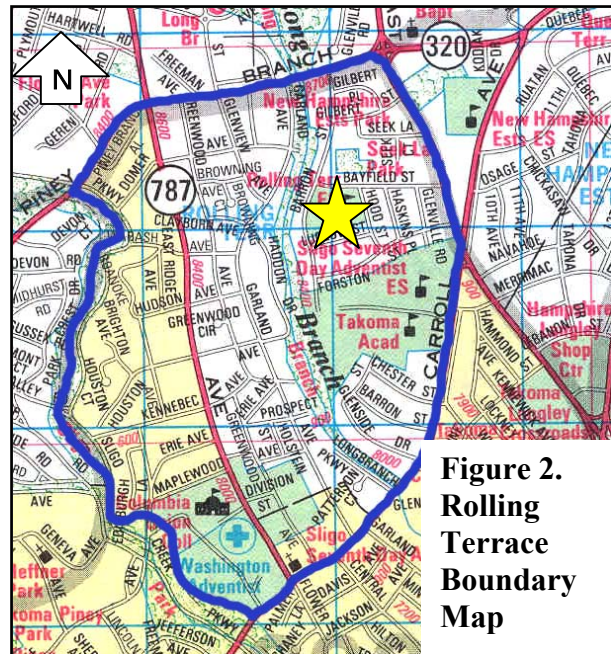


Figure 2.
Rolling Terrace Boundary Map

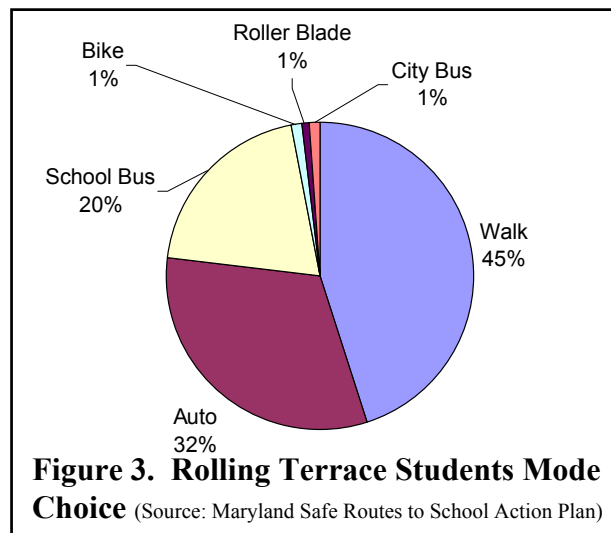
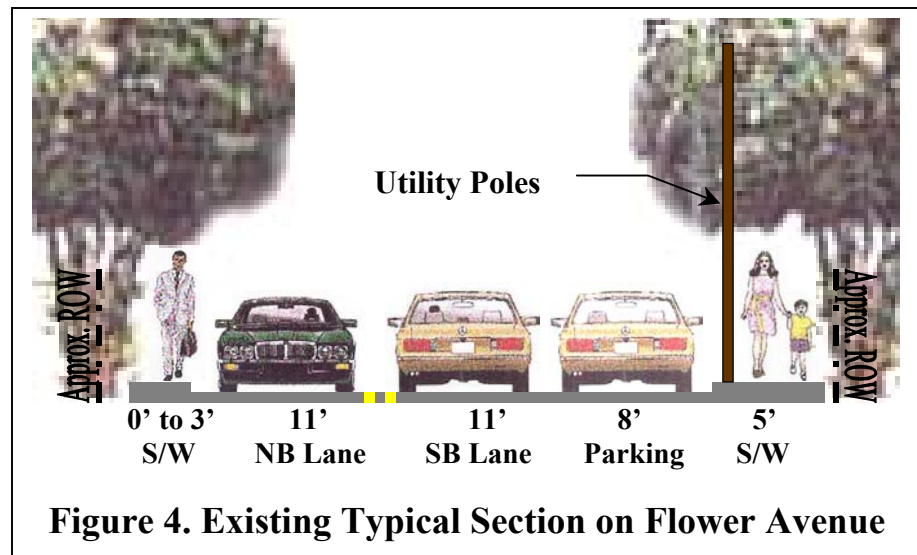


Figure 3. Rolling Terrace Students Mode Choice (Source: Maryland Safe Routes to School Action Plan)

asphalt and varies in width between several inches and 3 feet. Overhead aerial lines and utility poles (power, telephone, cable) are located along the west side of the roadway.

Preliminary right-of-way research revealed limited information. The plats that are available are located at the northern and southern ends of the corridor, where the right-of-way varies. Based on field observations as to the locations of sidewalks, fences and retaining walls, it appears that the right-of-way lines are immediately behind the sidewalk. Additional right-of-way research would be necessary for more detailed design studies. The existing typical section on MD 787 (Flower Avenue) is shown in **Figure 4**.



The existing typical section on MD 787 (Flower Avenue) is shown in **Figure 4**.

V. TRAFFIC CONTROL DEVICES

A. Traffic Signals

Traffic signals are located on MD 787 at MD 320, Columbia Union College and MD 195. The signal at Columbia Union College is a pedestrian signal. The signals at MD 320 and MD 195 have crosswalks and pedestrian signals on all legs of the intersection. A crossing guard controls the intersection of Flower Avenue at Domer Avenue during the AM peak hour.

B. Pavement Markings

Crosswalks are installed at every block along Flower Avenue. In general, the crosswalk lines are faded. At the northern and southern limits of the Flower Avenue, 25 MPH pavement markings are installed. The 25 MPH markings on the north side of the corridor are also faded.

C. Signing

There is an all-way stop intersection at MD 787 (Flower Avenue) and Houston Avenue. Symbolic STOP AHEAD signs are posed on both approaches to the intersection. The STOP sign on the northbound approach is obstructed by bushes and becomes visible only at 190 feet from the stop line. This distance is adequate for 25 mph speed, but not adequate for the 30 mph prevailing speeds. AASHTO's recommended stopping sight distance for 30 mph is 200 feet. STOP pavement markings are installed before the stop lines on MD 787. Advance school crossing signs are posted on both approaches of Flower Avenue at Domer Avenue. The school crossing sign is installed on the southbound approach, but is missing on the northbound approach. There are a lot of NO PARKING signs posted along both sides of MD 787 that are faded.

VI. INTERSECTION SIGHT DISTANCE

Intersection sight distance measurements were taken at each intersection in the study corridor. They were then compared to those recommended in AASHTO's, A Policy on Geometric Design of Streets and Highways, 2000 Edition. **Table 1** summarizes the measured values, compares them to AASHTO's recommendations, and notes the obstruction if they do not meet AASHTO. The intersection sight distance recommended for a left turn is 280 feet, and for a right turn/through movement is 240 feet. These recommended values are based on 25 mph operating speeds from AASHTO (Exhibits 9-55 and 9-58). As shown in Table 1, there are sight distance restrictions at Domer, Wabash, Hudson, Erie and Maplewood Avenues. The obstructions are due to parked vehicles, trees, shrubs and utility poles. Based on field observations, the shrubs and trees that are restricting sight distances appear to be located on private property.

TABLE 1. Intersection Sight Distance Measurements

<u>Intersection</u>		<u>Measured Sight Distance</u>		<u>Meets AASHTO?</u>		<u>Obstruction</u>	
		<i>Looking Left</i>	<i>Looking Right</i>	<i>Looking Left</i>	<i>Looking Right</i>	<i>Looking Left</i>	<i>Looking Right</i>
Domer Avenue	EB	100'	>300'	NO	Yes	Parked Cars	
	WB	180'	>300'	NO	Yes	Vegetation	
Wabash Avenue	EB	210'	200'	NO	NO	Parked Cars	Vegetation
	WB	>300'	>300'	Yes	Yes		
Hudson Avenue	EB	>300'	>300'	Yes	Yes		
	WB	100'	175'	NO	NO	Vegetation	Vegetation
Kennebec Avenue	EB	>300'	>300'	Yes	Yes		
	WB	>300'	>300'	Yes	Yes		
Erie Avenue	EB	>300'	125'	Yes	NO		Parked Cars
Maplewood Avenue	EB	185'	>300'	NO	Yes	Parked Cars	
	WB	200'	215'	NO	NO	Vegetation	Vegetation
Division Street	EB	>300'	>300'	Yes	Yes		

VII. TRAFFIC VOLUMES

District 3 Traffic provided traffic volume counts performed in the spring of 2002. A summary of the peak hour volumes is shown in **Figure 5**. The Average Daily Traffic (ADT) on MD 787 between Houston and Domer Avenues is 7,800 vehicles. The peak direction of traffic on MD 787 is northbound in the AM peak and southbound during the PM peak. Traffic volumes are slightly higher near MD 320 than near MD 195. The AM peak demand is approximately 400 vehicles north of MD 195, and approximately 530 vehicles south of MD 320. The PM peak demand is approximately 560 vehicles north of MD 195, and approximately 800 vehicles south of MD 320. District 3 Traffic also provided Critical Lane Volume (CLV) intersection capacity analyses at the signalized intersections in the corridor. **Table 2** summarizes the results of the capacity analysis. The results indicate that MD 787 operates at an acceptable level of service during the AM and PM peak periods.

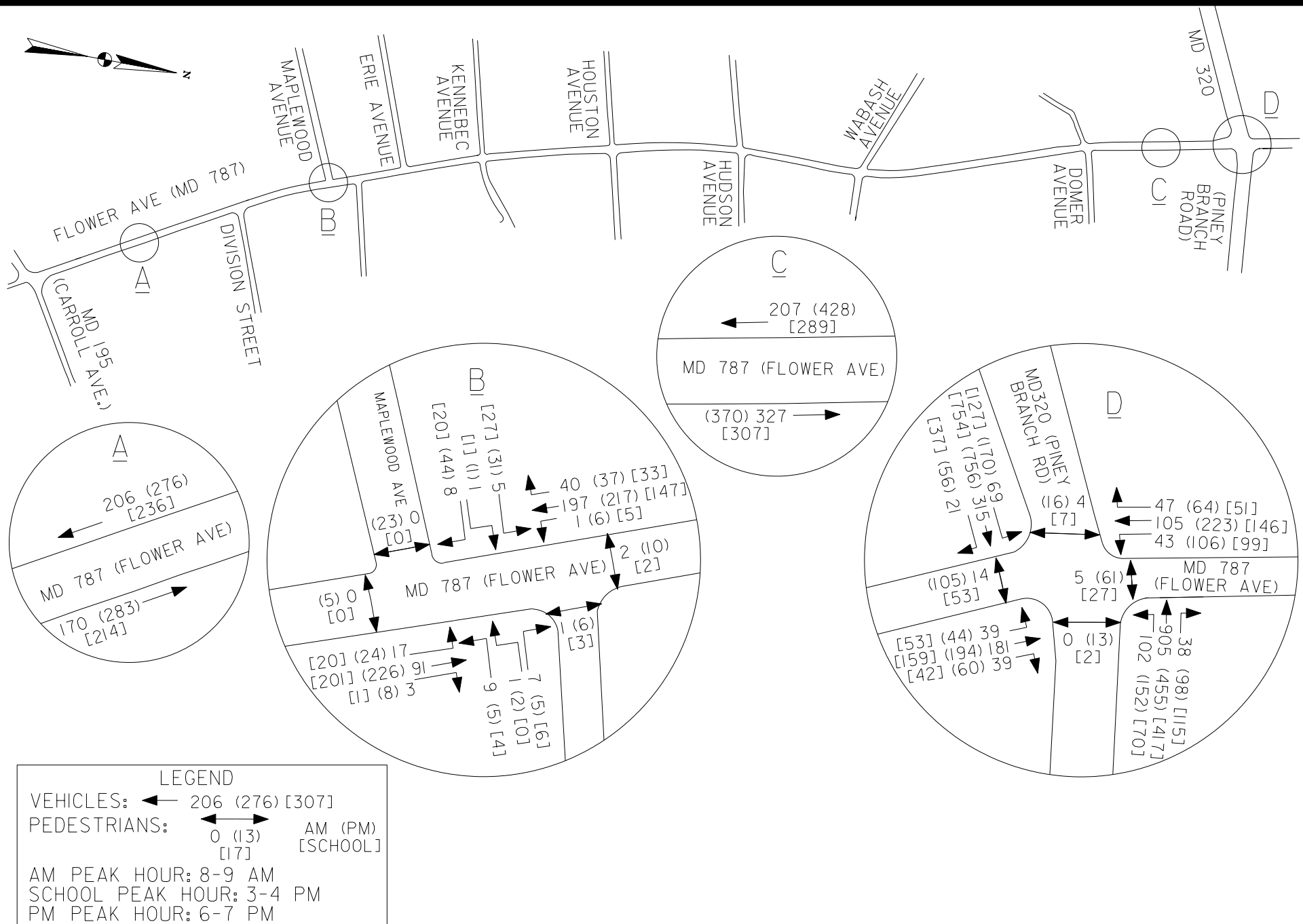


TABLE 2. Results of Intersection Capacity Analysis

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	v/c	LOS	v/c
MD 787 at MD 320	A	0.57	A	0.54
MD 787 at Columbia Union College	A	0.12	A	0.18
MD 787 at MD 195	A	0.49	B	0.69

VIII. SPEEDS

District 3 Traffic provided speed data on MD 787 (Flower Avenue) between Domer Avenue and Houston Avenue that was collected in April 2002. A summary of the data is shown in **Table 3**. The posted speed limit is 25 mph. The median speeds are close to the posted speed limit. The 85th percentile speeds are approximately 10 mph over the posted speed limit.

TABLE 3. Results of Spot Speed Study

Direction/ Location	Speed (mph)					
	Posted	Mean Speed ¹	85 th Percentile ²	10 MPH Pace ³	% in Pace ⁴	Percent Enforceable ⁵
NB Flower Avenue	25	31	35	26-35	74.0%	15.9%
SB Flower Avenue	25	25	33	26-35	58.4%	6.3%

1 – Mean speed is the average speed.

2 – 85th percentile speed is the speed at which 85 percent of the vehicles were traveling below when unaffected by other vehicles or whether, and is used by engineers as a good indication of the speed at which the majority of motorists consider safe and reasonable.

3 – The 10 mile-per-hour pace is the range of speed within 10 miles-per-hour of the 85th percentile.

4 – The percent in the 10 mile-per-hour pace reflects the percentage of vehicles that were traveling within this pace, and is a good indicator of the range of speeds along a particular segment of roadway.

5 – Percent of motorists traveling more than 10 miles per hour above the posted speed limit.

IX. GENERAL OBSERVATIONS

The following are based on field observations of MD 787 during peak school periods and off-peak, non-school periods:

- Parking along the west side of MD 787 appears to be heavily utilized
- There appears to be a relatively high number of pedestrians walking along MD 787 and/or waiting for a bus.
- Most of the pedestrian activity on MD 787 is localized to the area around MD 320, due to shopping in this area.
- Transit appears to be heavily utilized and the service is relatively frequent.
- There are a relatively high number of school-aged students crossing Flower Avenue before and after school hours. For example, observations conducted between 3:15 and 3:30 PM at Flower Avenue and Domer Avenue revealed that 5 elementary school aged children crossed Flower Avenue. Similar observations were made at other intersection in the corridor.
- In general, pedestrians crossed Flower Avenue at designated crossings, and did not exhibit unsafe behavior (running across the street, waiting in the middle of the street, walking in the street, walking between parked or queued vehicles).

- One school bus was observed dropping off passengers in the afternoon peak period. All vehicles on Flower Avenue stopped while approximately a dozen school-aged children got off the bus and subsequently crossed Flower Avenue.

X. TRANSIT

Montgomery County Ride-On operates 3 routes along MD 787, the No. 13, 12 and 25. There are sixteen bus stops in the corridor, eight in each direction. Bus stops are generally located at each block and there is one midblock location.

Figure 6 illustrates the bus stop locations, with total northbound and southbound boarding and alighting volumes,

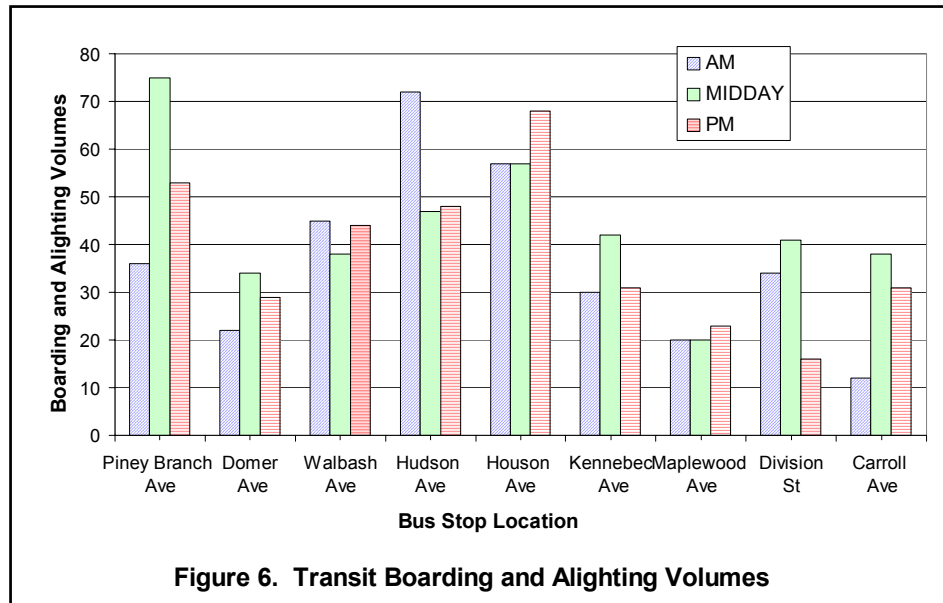


Figure 6. Transit Boarding and Alighting Volumes

separated by the AM, Midday and PM peak run times. As shown in Figure 6, there are a relatively high number of pedestrians on Flower Avenue in the vicinity of the bus stops.

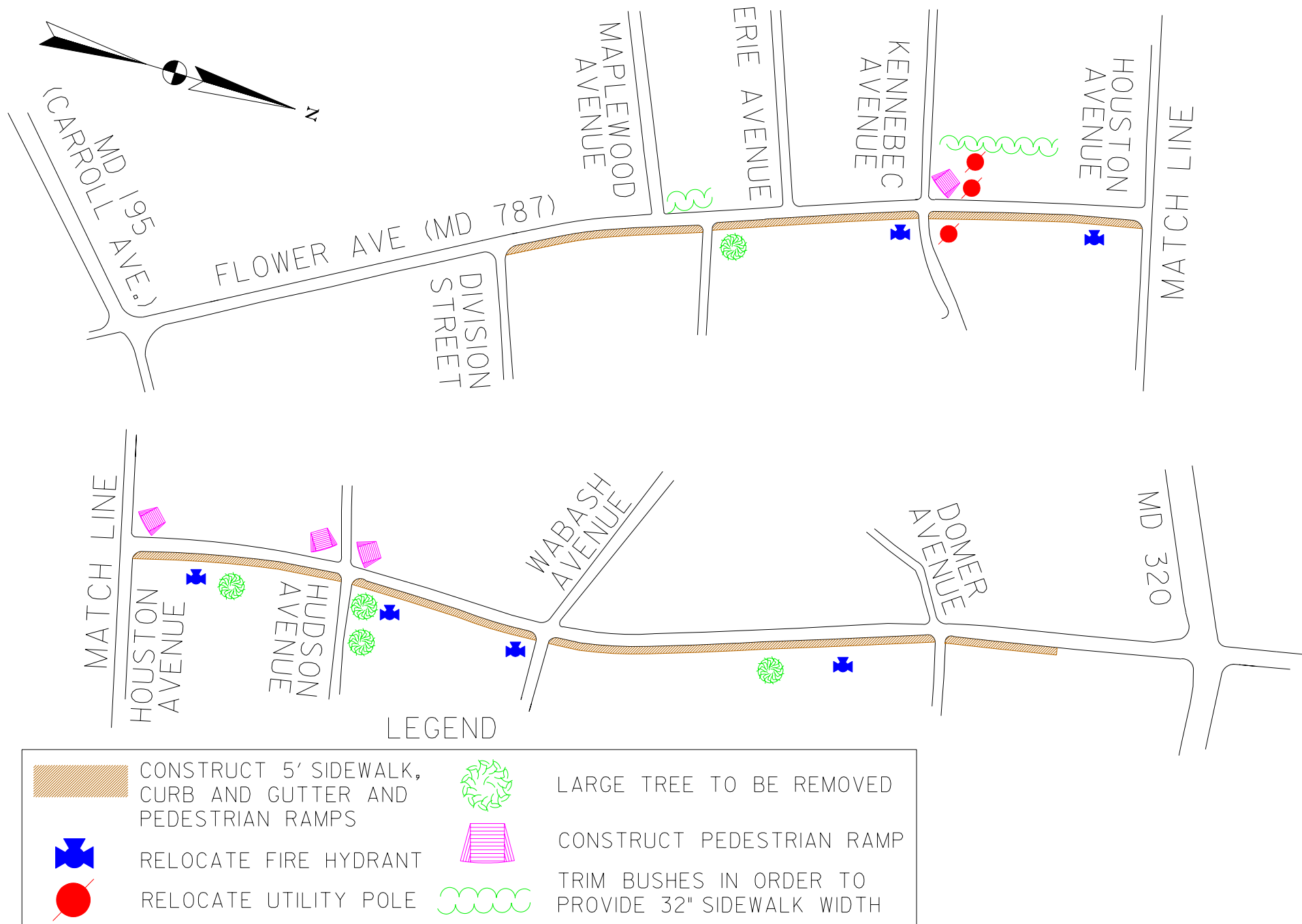
XI. DEFICIENCIES IN PEDESTRIAN FACILITIES

Sidewalks along MD 787 (Flower Avenue) were evaluated based on their conformance with the November 2002 Maryland State Highway Administration's Americans with Disabilities Act (ADA) Guidelines. The focus of the evaluation was on the following:

- The minimum desirable width for sidewalks shall be 60"
- The absolute minimum width for sidewalks to be utilized is 36"
- Vertical elevation differences between adjacent surfaces shall not exceed 1/4"
- The minimum width at pinch points is 32"
- Ramps provided at pedestrian walkways
- Minimum width on sidewalk ramps of 40"
- Ramps located within 2' of crosswalk striping

The most significant issue is the lack of an acceptable sidewalk on the east side of MD 787. The sidewalk is missing in large sections; where there is a sidewalk there are vertical elevation differences greater than 1/4 inches and/or there are obstructions reducing the sidewalk width to less than 32 inches. Pedestrian ramps are missing at all but 3 locations on the east side.

The existing sidewalk should be removed and a new sidewalk should be constructed on the east side of the roadway. Except for a few locations, the sidewalk on the west side meets the requirements listed above. **Figure 7** illustrates the minimum recommended sidewalk improvements.



Sabra, Wang & Associates
 1504 Joh Ave Suite 160
 Baltimore, Maryland 21227
www.sabra-wang.com

MD 787 (Flower Avenue)

Traffic Calming Study

Figure 7

Recommended Sidewalk Improvements

XII. TRAFFIC CALMING

Traffic calming schemes have traditionally not been considered on SHA roadways. However, Flower Avenue is not a typical state roadway and has a character that more closely resembles a county minor collector roadway. As has been demonstrated, there are a relatively high number of pedestrians walking along and crossing Flower Avenue, the 85th percentile speeds on Flower Avenue are approximately 10 mph higher than the posted speed limit, and the intersection sight distances are not adequate for even a 25 mph roadway. Additionally, Flower Avenue has a history of accidents at a rate significantly higher than the statewide accident rate. Therefore, even though traffic calming is not normally considered on SHA roadways, the above factors give cause to considering traffic calming in an attempt to improve safety for pedestrians and motorists. **Table 4** evaluates various traffic calming devices and their suitability to Flower Avenue.

TABLE 4. Suitability of Traffic Calming Devices to Flower Avenue

Traffic Calming Devices	Suitable to Flower Avenue?	Reason for not Considering	
Reduce Speed Limit	NO	The existing speed limit is posted at the minimum limit.	
Intersection Diverters, Forced Turns and Turn Prohibitions	NO	Diverters and turn prohibitions are volume control measures. The through volumes on Flower Avenue are too high (ADT of 7,800). Consideration may be given to turn prohibitions from the side streets.	
Speed Humps, Speed Tables, Raised Crosswalks and Mini-Circles	NO	The Washington Adventist Hospital and the Takoma Park Volunteer Fire Station both frequently ¹ use Flower Avenue to respond to emergencies. Speed Humps would reduce speeds of emergency vehicles too much. ²	
Choker/ Narrowing	YES	Chokers that reduce the traveled way to one-lane for both directions should not be considered. Narrowing the traveled way to two-lane widths through chokers should be considered.	
Roundabout	NO	Roundabouts perform best at intersections with balanced traffic volumes on each approach. ³ The only intersections that appear to qualify are at MD 320 and MD 195. Additional traffic engineering analyses would be needed to determine if these are feasible. Another factor is that right-of-way would likely be required for a roundabout at these intersections.	
Pedestrian Barriers	NO	Barriers are used to direct pedestrians away from hazardous crossings and to channel them to a safer crossing location. The disadvantages are that the barrier-system constitutes by itself a fixed-object hazard, and that proper systems tend to be costly for low-speed urban facilities. ⁴ If installed, a pedestrian barrier-system would reduce sidewalks widths to an unacceptable level. Right-of-way would most likely be required in order to provide adequate sidewalk widths with the barrier-system. Furthermore, field observations revealed that pedestrians currently use designated crossings.	

¹ Based on telephone conversations with Captain Coursey (301-270-8209) and Washington Adventist Hospital (301-891-7600) in Sept. 2003.

² An August 1997 Montgomery County study recommended that response routes used extensively by fire vehicles be kept free of speed humps and traffic circles. This is consistent with the recommendation in the Institute of Transportation Engineers *Guidelines for the Design and Application of Speed Humps*.

³ Maryland State Highway Administration, *Roundabout Design Guidelines*

⁴ Institute of Transportation Engineers, *Design and Safety of Pedestrian Facilities*, March 1998.

Traffic Calming Devices	Suitable to Flower Avenue?	Reason for not Considering
Median Islands	NO	Center Islands may be implemented at several locations on Flower Avenue. However, their use would be limited due to the high number of driveways accessing Flower Avenue. The center islands should not block access to driveways.
Chicane	YES	N/A
Crosswalks	YES	N/A

The chicane is the recommended alternative. The chicane would be used to create a serpentine alignment along Flower Avenue by alternating parking between the east and west sides of the roadway. Recessed parking bays would be constructed to protect parked vehicles and to reduce intersection widths. Utilities currently located in, and obstructing the sidewalk may be relocated into the bump-outs created for the recessed parking bays. Narrow intersection widths reduce the amount of time pedestrians are exposed to traffic, creating a safer environment. The serpentine alignment could also physically constrain motorists from traveling at higher speeds. A reduction in operating speeds would improve operations for motorists turning from side roads with obstructed sight distances. In order to implement this alternative, several bus stops would have to be relocated from a near-side to far-side stop, or vice-versa. **Figure 8** illustrates the recommended concept through the study corridor. The concept is not illustrated south of Division Street since parking is currently prohibited in this area. The concept could be extended through this area if the parking regulation were changed since there is adequate street width. If the regulation does not change, a general narrowing of the street throughout this area should be considered. It should be noted that the overall number of on-street parking spaces would not change significantly under this concept. **Figure 9** compares parking on a block-by-block basis under existing and proposed scenarios.

Figure 10 illustrates the typical plan. It should be noted that the plans presented are very conceptual. If these concept plans are taken to the next stage of design, consideration must be given to utility and right-of-way impacts and geometric design details.

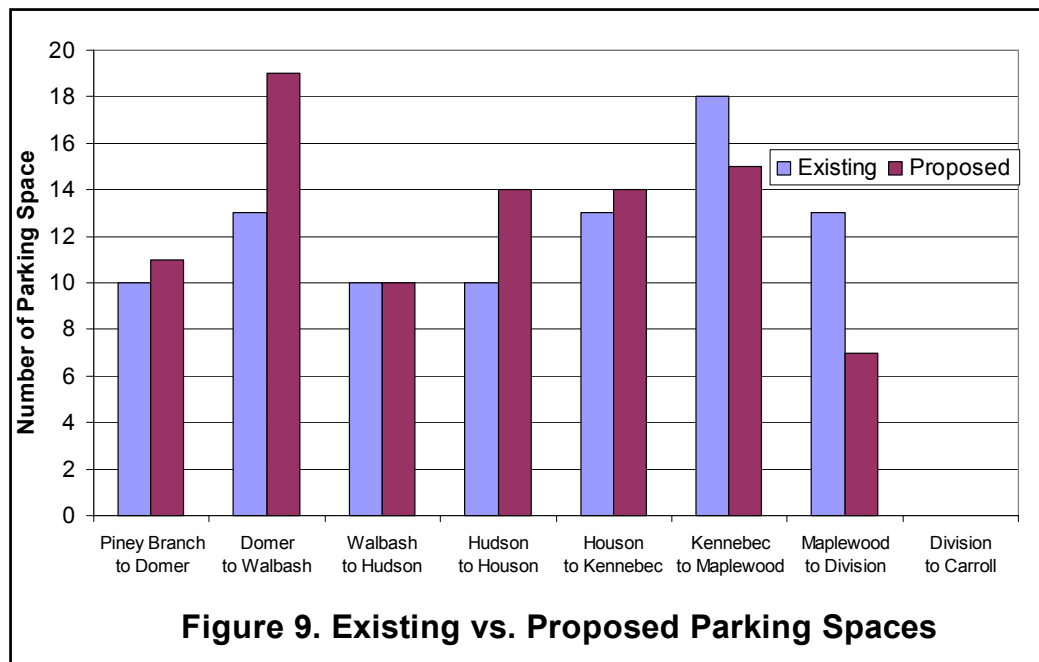
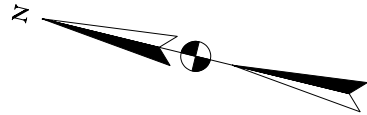


Figure 9. Existing vs. Proposed Parking Spaces



MATCHLINE SEE THIS SHEET

MATCHLINE SEE THIS SHEET

LEGEND

- Parked Vehicle
- Double Yellow Centerline
- Proposed Sidewalk
- Proposed Curb



Sabra, Wang & Associates
1504 Joh Ave Suite 160
Baltimore, Maryland 21227
www.sabra-wang.com

MD 787 (Flower Avenue)

Traffic Calming Study

Figure 8

Recommended Improvements

